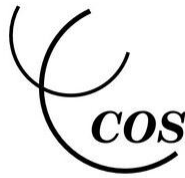


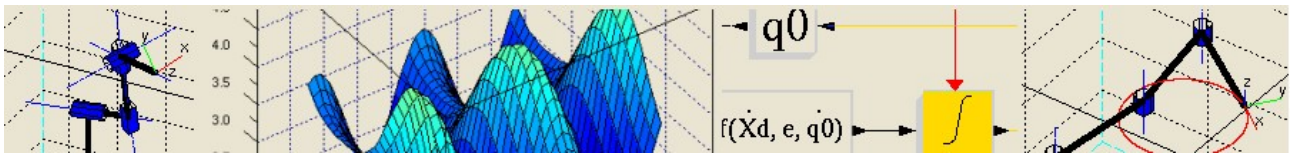
Simulation and automatic code generation for real time embedded systems using ScicosLab/Scicos and Erika/Linux



www.scicoslab.org



www.scicos.org



I° Italian course - "Red October"

Tutors:

Simone Mannori - ScicosLab developer (www.scicos.org, www.scicoslab.org)

Paolo Gai - Evidence S.r.l. (<http://www.evidence.eu.com/>)

Roberto Bucher - SUPSI Lugano (<http://linux3.dti.supsi.ch/~bucher/>)

Matteo Morelli - RTSS developer (Centro "E. Piaggio", Pisa Univ., <http://rtss.sourceforge.net/>)

Daniele Mazzi - Siena University

Location

Florence University - Plesso didattico, Viale Morgagni 40, Firenze, ITALY

Time

19/20/21 October 2010

Morning: 9:00 – 13:00 / Afternoon :14:00 - 17:00

Web page:

<http://erika.tuxfamily.org/scilabscicos/scicoslabcourse2010.html>

Registration

Registration is mandatory: <https://www.softconf.com/b/scicoslab2010/>

Languages

- Italian as default spoken languages, English and French on request. Books and documents in English.

Target audience

- Students, engineers and scientists working with complex simulations and control systems design.

Prerequisites

- A portable personal computer (Linux/ Windows/ Mac OSx)
- A clean USB key for file exchange
- Internet access is not required *but could be useful*

Note for Windows users: some exercises require the presence of a C compiler. Under Linux "gcc" is installed as default (check with "gcc -v"). Windows users must install Visual C/C++ Studio Express 2008 (this version is freely downloadable from Microsoft's web site).

References

- The new Yellow Book: [Modeling and Simulation in Scilab/ Scicos With Scicoslab 4.4](#), Stephen L. Campbell, Jean-Philippe Chancelier, et Ramine Nikoukhah
- On line documentation available here: <http://www.scicos.org/documentations.html>

Rationale

This three days course is a general purpose introduction to the art of dynamical systems simulation and automatic code generation for real time embedded systems using ScicosLab/Scicos. We will make references and comparisons with Matlab/Simulink and Kepler. The course is focused on ScicosLab/Scicos, ERIKA, Scicos-FLEX, RTSS (Robot Toolbox) and real time industrial communication buses.

Day One: "Basic".

Morning sessions

1./ "ScicosLab/Scicos for dummies like us" - Simone Mannori (2h)

A gentle introduction to simulation and automatic code generation.

- ScicosLab basic features
- Scicos: a dynamical systems simulator
- What a dynamical system is ?
- Mathematical models
- Differential equations (explicit and implicit form, linear and non linear)
- Modelica language and simulations
- Continuous, discrete and hybrid systems
- How Scicos works (basic introduction to the internal structure)
- Basic example of code generation

2./ "Real Time Operating Systems for embedded applications" Paolo Gai (2h)

- Introduction to embedded real-time systems
- Introduction to the FLEX Boards
- Introduction to the OSEK/VDX operating system and ERIKA Enterprise

Afternoon: workshops

1./ "ScicosLab/Scicos familiarization" - Simone Mannori (2h)

- How to configure and compile ScicosLab
- Familiarisation with ScicosLab
- Familiarisation with Scicos
- How to build a diagram and run a simulation
- Import/export simulation's results

Exercises (physical modelling, simulation, controller design)

- DC motor
- Three pole RC filter

- Coupled mechanical oscillator
- Basic block development.

2./ “OSEK/VDX and ERIKA Enterprise Examples “ - Paolo Gai (1h)

- Programming examples

Day two:

"We do ScicosLab - and other things - not because they are easy but because they are hard".

Morning sessions

1./ "Scicos guts. No guts, no glory." - Simone Mannori, Roberto Bucher, Paolo Gai (2h)

ScicosLab from a development standpoint

- How to develop a simple Scicos block from scratch
- Interfacing and computational function structures
- Scicos-FLEX: the Flexible Code Generator from Switzerland (Roberto Bucher)
- Scicos-FLEX internals

2./ "Real Time Operating Systems for embedded applications" Paolo Gai, Roberto Bucher (2h)

- OSEK/VDX and ERIKA Enterprise examples
- Details on the code generation using ScicosLab and the FLEX Boards

Afternoon: workshops

1./ Simone Mannori (1h)

- Scicos Blocks development with examples
- Scicos FLEX code generator usage and development (with examples)

2./ Paolo Gai (1h)

Code generation examples with ScicosLab

Day three:

"ScicosLab is who ScicosLab does".

Morning sessions

1./ “ScicosLab/Scicos for robotics applications” - Matteo Morelli (1.5h)

- RTSS: the Robotics Toolbox for Scilab/Scicos
- Rigid motions representation in R^3 with ScicosLab
- Robotic manipulators modelling with ScicosLab
- Robotic control systems simulation with Scicos
- Robot control code generation for use with Linux RTAI

2./ ScicosLab/Scicos and CanOpen – Roberto Bucher (45')

- CAN bus and CanOpen protocol
- How CanOpen device can be integrated in a Scicos block
- Learn how to implement new CanOper devices
- Introduce CAN200 interface card

3./ Design and simulation of switched mode power supplies – Daniele Mazzi, S.Mannori (45')

- Mathematical models of switching circuits
- Controllers design and simulation
- Code generation for real applications

4./ Wrap up session - Simone Mannori, Paolo Gai - (1h)

- What you have learnt during the last three days?
- What you have enjoyed/hated ?
- Suggestion to improve the training course.

Afternoon: workshops

1./ Matteo Morelli

- Installation of RTSS
- Review of some basic examples included in the distribution
- Kinematic models of simple planar manipulators from real data
- From task space to joint space references via kinematic inversion
- Adding dynamics to the models: dealing with real inertial and actuator/transmission parameters
- Joint space centralized control of the planar manipulators developed above
- Controller code generation for Linux RTAI

2./ Roberto Bucher

CanOpen communication exercise

3./ Simone Mannori, Daniele Mazzi and Paolo Gai will be available on site.